

## SUISUN SONG SPARROW (*Melospiza melodia maxillaris*)

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### Criteria Scores

Population Trend	Range Trend	Population Size	Range Size	Endemism	Population Concentration	Threats
10	0	5	10	10	5	10

### Special Concern Priority

The Suisun song sparrow is currently considered a Bird Species of Special Concern (year-round), Priority 3. No subspecies were included on the original list (Remsen 1978), but all three San Francisco Bay tidal marsh song sparrow subspecies were included on CDFG's (1992) list, including Suisun song sparrow.

### Breeding Bird Survey Statistics for California

No data reported at the subspecies level (Sauer et al. 2000)

### General Range and Abundance

The Suisun song sparrow is a California endemic. Its year-round range is confined to tidal salt marsh and brackish marsh habitat fringing the Carquinez Strait and Suisun Bay east to Antioch, at the confluence of the San Joaquin and Sacramento River (Grinnell and Miller 1944; PRBO unpubl. data).

Suisun song sparrow is distinguishable from most of the other Bay Area song sparrow subspecies by its unique large, dorsally inflated bill, and its coloration and size. Dorsal coloration tends to be a darker chocolate brown than other song sparrow subspecies in the region, although a proportion of the birds in the Southamptton Bay (Benicia) population are a blackish olive similar to birds found in San Pablo Bay (*M. m. samuelis*, San Pablo song sparrow) and a dark olive brown as seen in upland portions of Solano County (*M. m. gouldii*, Marin song sparrow; Marshall 1948b). It is the largest of the region's song sparrow subspecies in terms of bill length, bill depth, weight,

tarsus length and wing length, with populations in northern Suisun being larger than those in southern portions of Suisun or the Carquinez Strait (Marshall 1948b). Recent genetic analyses (using micosatellites) suggest that the Suisun song sparrow is not significantly genetically distinct from the San Pablo song sparrow or the subspecies *M. m. heermanii* found in Sacramento Valley riparian habitat (Chan and Arcese 2002).

### **Seasonal Status in California**

Occurs year round; breeding season extends from early March to July.

### **Historical Range and Abundance in California**

Grinnell and Miller (1944) described the Suisun song sparrow as an “abundant” resident in the brackish estuarine marshes at or near sea level, in the area surrounding Suisun Bay from the “vicinity of confluence of Sacramento and San Joaquin rivers (near Antioch) west to Carquinez Straits.” This included the once vast brackish tidal marshes in northern Suisun Bay, the marshes along the southern edge of the Bay in northern Contra Costa County, an isolated area of marsh in what is now Benicia, and numerous marsh islands probably as far east as Browns Island near Antioch.

Specimens were collected prior to 1944 in Antioch, Martinez and Port Costa, Contra Costa County; and at Grizzly Island, Cordelia Slough and Benicia, Solano County (Grinnell and Miller 1944).

No quantitative estimates of historic abundance exist. Prior to development, diking and filling that began in the 1800’s, there were approximately 26,000- 26,500 ha of tidal marsh fringing Suisun Bay (SFEI 1998; Marshall and Dedrick 1994). By 1944, much of the tidal marsh had already been diked for grazing or farming, and beginning in the 1920’s many of the non-tidal diked areas were converted to managed marsh by the State and private waterfowl hunting clubs (Goals Project 1999). Grazed and farmed areas are assumed to be inappropriate habitat for song sparrows,

but once converted to managed marsh, the habitat value for song sparrows in some areas may have improved.

Based on Grinnell and Miller's (1944) observations, and recent studies (PRBO unpubl. data) indicating song sparrows are presently ubiquitous residents of even the smallest marsh fragments where sufficient high marsh vegetation exists, we assume that Suisun song sparrows were present pre-development throughout Suisun Bay marshes. We also assume that densities were similar to current mean estimates of 14.9 birds per ha (95 % c.i.: 11.3 to 19.6, Nur et al. 2001). The total population size prior to development and diking was thus probably between 300,000 and 500,000 birds.

### **Recent Range and Abundance in California**

The general range of the Suisun song sparrow is probably relatively unchanged since Grinnell and Miller's (1944) account, although its presence in particular areas of the bay may have changed due to habitat loss and degradation, or habitat improvement and restoration. As indicated above, by 1944 much of the historic tidal marsh habitat had already been diked for grazing and agriculture and a large proportion has since been converted to managed wetlands for waterfowl. Suisun song sparrows are most likely to be found in fully tidal marshes and some muted marshes (depending on vegetation and tidal regime), but their distribution and abundance in managed and diked marsh is not well studied and undoubtedly also varies with water management regime and associated vegetation (Cogswell 2000; PRBO unpubl. data).

Current estimates of marsh habitat in Suisun Bay are 3,735 ha fully tidal marsh; 1,842 ha muted marsh, and 20,069 ha managed and diked marsh (SFEI 1998). Thus the total area of potentially available habitat (including only fully tidal and muted marsh) is presently about 20% of the historic area of tidal marsh.

Suisun Bay tidal marshes are highly fragmented and separated by large areas of managed marsh, especially in northern Suisun Bay within Grizzly Island. There are no continuous tracts of

fully tidal marsh greater than 1000 ha; 13 parcels are greater than 100 ha, 103 are between 2 ha and 100 ha and 76 are smaller than 2 ha (SFEI 1998). Half of the existing tidal marsh habitat, and thus presumably at least half of the existing population of Suisun song sparrows, is probably found within the 7 largest sites.

The abundance, density and distribution of Suisun song sparrows have been studied extensively at 15 tidal marsh sites in Suisun since 1996 using variable circular plot point count surveys and spot mapping methods (Nur et al. 1997; Nur et al. 2001). Previous attempts to calculate regional abundances and population sizes have used density or abundance estimates from one or only a few sites, or used data from San Pablo song sparrow population studies (Walton 1975, Marshall and Dedrick 1994). Others have also used different survey methods, including surveying in linear transects along tidal channels, which make comparisons between studies difficult (Walton 1975, 1978). During surveys in Suisun Bay from 1996 to 2002, Song sparrows were found in every tidal marsh site, and several restoration and managed marshes (PRBO unpubl. data). In managed marshes, song sparrows tend to be found in relatively low numbers in taller vegetation such as cattails and *Scirpus* spp found next to pooled water along levees; they tend to be absent where the marsh is permanently flooded or allowed to dry completely in the spring and summer (Walton 1975; Marshall and Dedrick 1994; PRBO unpubl. data).

Suisun song sparrows range in abundance from sparse to very numerous. Absolute densities (calculated with DISTANCE software; Buckland et al 1993) range from fewer than 5 birds per ha in tidal marsh on Hill Slough and Cordelia Slough to more than 21 birds per ha in tidal marsh at Martinez Shoreline (PRBO unpubl. data). The mean density for 11 Suisun Bay sites surveyed in 2000 was 14.9 birds per ha (95 % confidence interval 11.3 to 19.6 birds/ha; Nur et al. 2001). Densities derived independently from intensive spot-mapping efforts in 2000 and 2001 ranged from 4.23 to 4.53 territories per ha at Benicia State Park (8.26 to 9.06 breeding birds per ha); 3.28 to 3.47 territories per ha at Rush Ranch (6.56 to 6.94 breeding birds per ha; PRBO unpubl. data). Marshall

(1948) found 2.75 birds/ha at Benicia in the 1940's. Marshall and Dedrick (1994) spot mapped the same area at Rush Ranch in 1990 and found 2.56 pairs/ha (5.13 individuals/ha).

The most recent estimate of the total numbers of Suisun song sparrows is approximately 40,000 to 66,000 birds in 2000 (Nur et al. 2001). This number is based on an estimated area of 3735 ha of tidal marsh (EcoAtlas, SFEI 1998) and the mean absolute density of 11.3 to 19.6 birds per ha for Suisun Bay. Marshall and Dedrick (1994) estimated the present population size at 9,530 pairs or about 19,000 individuals. This figure was derived from a calculated area of 3480 ha tidal marsh and Johnston's (1956b) lower density of 5.49 birds per ha for San Pablo Bay song sparrows studied in Richmond, CA. The number of pairs using managed marsh in the Grizzly Island area has not been thoroughly studied; Marshall and Dedrick (1994) estimated at least 200 additional pairs using this habitat, but true numbers may be much higher (pers. obs.).

### **Ecological Requirements**

Suisun song sparrows have been found in virtually every tidal salt marsh studied in Suisun Bay, but as discussed above densities varied considerably, presumably due to variation in habitat suitability (e.g., vegetation structure and type, tidal regime), and other factors affecting habitat choice, predation and other sources of mortality (PRBO unpubl data). As with all song sparrow subspecies throughout their range, dense vegetation is required for nesting sites, song perches, and as cover for refuge from predators (Marshall 1948a). Where vegetation is too short and sparse, Suisun song sparrow nests are more likely to be exposed to predators and potentially become flooded during spring tides (Marshall 1948a; Johnston 1956a; PRBO unpubl data). The dominant plants of tidal marshes in Suisun Bay vary significantly with salinity. In salt marsh such as portions of Benicia State Park at Southamptton Bay, there is California cordgrass (*Spartina foliosa*) in low elevations, pickleweed (*Salicornia virginica*) at higher elevations, and gumplant (*Grindelia stricta*) on higher ground along slough edges and man-made levees. In more brackish areas of Suisun Bay there is a larger diversity of plants and the above species are inter-dispersed with large numbers of other

species; common plants include tules and other *Scirpus* species (*Scirpus acutus*, *S. americanus* and *S. californicus*), cattails (*Typha* spp), rushes (*Juncus balticus*), and increasingly, the non-native invasive peppergrass, *Lepidium latifolium*.

Suisun song sparrows are primarily associated with tidal channels, especially in marshes dominated by pickleweed in which gumplants line the channels, or in brackish marshes where other tall, thick vegetation, such as *Scirpus* spp, is more likely to be found. Sparrow territories are lined single file every 10 to 50 m along sloughs providing each pair with access to the slough and its overhanging banks for food and cover. Suisun song sparrows use both natural and man-made channels (mosquito ditches). In San Pablo Bay, song sparrow territories along natural channels are smaller than those along man-made channels, suggesting the habitat is of higher quality (Collins and Resh 1985), but this has not been studied in Suisun Bay. In marshes where there are no sloughs, some tidal influence is still required, and in areas that are diked and the water is stagnant (which directly affects the vegetation) few song sparrows are found (e.g., southern Goodyear Slough). In marshes with significant cover of alkali bulrush (*Scirpus maritimus*), tules (*Scirpus acutus*), or cattails (*Typha* spp), all tall plants associated with brackish to fresh water (e.g., Point Edith and Rush Ranch), the association of song sparrows with channels is weaker (pers. obs.).

Finally, exposed ground for foraging has been noted as a requirement. In tidal salt marshes, dense *Salicornia* is opened by small mammal trails and tidal action. Marshall (1948a) notes that the densest vegetation within which song sparrows can exist is *Scirpus* whose base grows at least 2 to 5 cm apart, providing openings for foraging on the ground.

Statistical analyses of the relationship between tidal marsh song sparrow abundance and a series of vegetation and habitat variables collected around point count stations indicate that song sparrow abundance varies significantly with only 2 of the variables studied: sparrows tended to respond positively to shrub cover (primarily *Grindelia*) and negatively to *Juncus* cover, which tends to be too sparse or short for nesting (Nur et al. 2001). Variables that did not have a significant

relationship to differences in abundance included: *Distichlis*, *Typha*, *Scirpus* and other dominant plant species (Nur et al. 2001). Marshall (1948) noted that tidal marsh song sparrows were either absent or less dense where *Spartina* was less than 50 cm high or *Salicornia* was less than 30 cm high. At the landscape level, the Suisun song sparrow and other tidal marsh song sparrows are positively associated with marsh size, proximity to urban edge and proximity to larger marshes; i.e., song sparrows are more abundant near edges, and in larger, less-isolated marshes (Stralberg et al. 2001).

Suisun song sparrow nests are found in a large variety of substrates, including but not limited to: *Scirpus americanus*, *Scirpus maritimus*, *Scirpus acutus*, *Grindelia stricta*, *Lepidium latifolium*, *Salicornia virginica*, *Juncus balticus*, *Distichlis spicata* and *Triglochin maritima* (PRBO unpubl. data). Nests in *Lepidium* often fail when the plants reach their maximum height and start to fall over to one side *en masse* (pers. obs.), but overall success of nests built in *Lepidium* versus other plant substrates has not been studied. Nesting requirements in non-tidal, managed marsh habitat have not been studied, nor has the overall success of the nests built in this habitat.

### **Threats**

Further habitat loss, fragmentation and degradation are the primary threats to the Suisun song sparrow. Alteration of marsh habitat due to invasive species of *Spartina* and *Lepidium* may also have adverse effects. Increased diversion of fresh water from the San Joaquin and Sacramento Rivers is causing increases in salinity in Suisun Bay waters. This may cause changes in marsh vegetation from that adapted to more brackish conditions to that better adapted to saline conditions, particularly in the southern portion of Suisun Bay; the portion of tidal marsh in the northern extreme of the Bay (around Hill Slough and Rush Ranch) is less likely to be effected (Scollon 1993; Cogswell 2000). Although Alameda song sparrows are adapted to drinking salt water at the seawater concentrations, the tolerance of Suisun song sparrows to drinking salt water is unknown (Basham and Mewaldt 1987). It is assumed that Suisun populations are not currently exposed to

high salinities for more than several days at a time, particularly in the more brackish portions northern Suisun Bay, so an increase in water salinity is likely to have adverse effects. Basham and Mewaldt (1987) noted that upland sparrows (*M. m. gouldii*) were unable to maintain their weight when provided only with salty drinking water that Alameda song sparrows tolerated.

There are also concerns that habitat fragmentation and lack of sufficient dispersal corridors in portions of the Bay (including within northern Suisun) will impede dispersal in the aftermath of catastrophic disturbance, or habitat changes such as those resulting from rapid salinity changes discussed above (Scollon 1993, Cogswell 2000). Because Suisun song sparrows and other tidal marsh subspecies are highly sedentary, it has been assumed that birds are unlikely to disperse across inhospitable habitat. Larsen (1989 cited in Cogswell 2000) assumed a maximum dispersal distance of 50 m across inhospitable habitat, which we believe is unrealistically small. However, maximum dispersal distance is not known. A study of color banded Suisun and San Pablo song sparrows has found that birds commonly disperse up to 1 km within tidal marsh habitat, but successful dispersal of birds from one study site to another (across large stretches of unsuitable habitat) has not yet been confirmed (PRBO unpubl. data). Although Chan and Arcese (in press) found no genetic differentiation between San Pablo and Suisun song sparrows and their neighbors to the east, there are two alternative explanations: a) dispersal occurs among the populations; or b) there has been insufficient time since genetic isolation for differences in microsatellite distribution to develop. Thus the ability of song sparrows to disperse across fragmented habitat is unknown. If birds from outside Suisun tidal marshes (such as upland populations or San Pablo song sparrows) are able to disperse into the Bay, it's not clear that they would be adapted to current conditions found in the bay. If these non-tidal birds breed with Suisun birds in the marsh, there is concern that they will dilute the genetic basis for the unique traits found in the marsh, a problem which may have already arisen in Benicia (Marshall and Dedrick 1994)

Reproductive failure caused by increasing levels of nest predation may also have a significant impact. Predators include non-native predators including house cats, Norway rats (*Rattus norvegicus*) and red fox (*Vulpes fulva*), and other native predators that respond to human disturbance such as crows and ravens. Increasing amounts of environmental contaminants may also affect reproductive success. Suisun song sparrow nest success is low; it ranged from 6.3 to 15% probability of nesting success per nest at Benicia State Park and 0 to 21.9% at Rush Ranch during the period of 1996 to 2001 (Chan et al 2002; Spautz et al. 2001). This is low enough in some years to cause concern. Nest success was significantly lower in the Suisun sites than at three San Pablo Bay sites studied during the same years (Chan et al. 2002). Predation is the primary cause of nesting failure (65% of nests; Chan et al. 2002); other causes include tidal flooding and abandonment or failure to hatch. Sites where nest success was lowest and predation rates highest were smaller, had higher perimeter to area ratios, and were more isolated (Chan et al. 2002). Even though Suisun song sparrows are present in marsh fragments that vary in size, smaller, more isolated marshes may be functioning as population sinks due to lower reproductive success rates.

Disturbances such as oil exploration, grazing and recreational use may contribute to habitat degradation, destruction of nests and/or nesting habitat, or disruption of breeding behavior. These activities should be minimized in fragile marsh habitat, particularly in areas already designated as protected wildlife areas.

There is potential for drastic impacts on tidal marsh habitat if the sea level rises due to global warming. Due to the presence of levees, tidal marsh may not be able to accrete (rise) landward to offset increasing inundation. The actual risk that sea level rise poses has not been established.

## Management and Research Recommendations

- Protect existing habitat and restore additional areas to tidal action in Suisun Bay. The goal would be to restore large contiguous areas to full tidal action in both the northern and southern portions of the Bay. The Goals Project (1999) recommends that tidal marsh habitat be increased by approximately 250% in Suisun, which would involve conversion from managed and muted marsh.
- Restore dispersal corridors, particularly in the highly fragmented areas in northern Suisun Bay. Dispersal corridors should have dense, moderately tall vegetation.
- Determine the water management and vegetation control practices used by private and public wildlife agencies that enhance waterfowl habitat while simultaneously enhancing breeding and dispersal habitat for song sparrows and other tidal marsh obligate birds including Common Yellowthroats, Black Rails and Clapper Rails; promote these practices in northern Suisun Bay, in particular where habitat fragmentation is the most severe.
- Conduct research on the impact of invasive exotic plant species on tidal marsh habitat, including their impact on song sparrows' and other tidal marsh species' population density and reproductive success. In particular, *Spartina alterniflora*, which has yet to invade Suisun Bay, and *Lepidium latifolium*, pepperweed, have the potential to alter the habitat significantly.
- Conduct research to identify habitat requirements and ecological conditions that support self-sustaining populations, with particular attention paid to ideal restoration of tidal marsh habitat.
- Conduct research to identify dispersal needs and constraints. Synthesize this information together with information on reproductive success and survival to determine long-term population viability.

- Identify important nest predators and evaluate predator control measures, if necessary, particularly for non-native predators.
- Study the effects of contaminants (including pesticides and agricultural run-off) on reproductive success.

Cogswell (2000) and Scollon (1993) provide detailed recommendations for improvements in connectivity between tidal marsh fragments in Suisun Bay to benefit Suisun song sparrow dispersal.

### **Monitoring Needs**

The Breeding Bird Survey and Christmas Bird count are inadequate for monitoring changes in the population size for this subspecies. The Suisun song sparrow is restricted primarily to tidal marshes; although some of these areas are accessible from roads, members of the public are not allowed to enter marsh habitat without a permit, due to US Fish and Wildlife Service regulations protecting the endangered California clapper rail and salt marsh harvest mouse. PRBO has been conducting standardized variable circular plot point counts in Suisun Bay tidal marshes since 1996, which allows the estimation of absolute density. Such monitoring should continue and be expanded to allow for tracking of population trends in tidal and managed marshes and restoration sites. More attention needs to be paid to the range of water management practices in Suisun Bay marshes managed for waterfowl, to determine which practices are likely to result in habitat appropriate for breeding tidal marsh obligate songbirds, such as Suisun song sparrows, for the entire breeding season. Reproductive success monitoring should also continue with the following objectives: tracking ambient conditions; assessing the impacts of non-native plants; assessing management and restoration practices; identifying causes of nesting failure; and identifying important nest predators. Other components of demography need to be monitored as well.

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